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Food product.

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FOOD PRODUCT

This invention relates to a food product, in particular a foodstuff comprising a fat continuous emulsion.

5

Fat continuous emulsions are contained in a number of foodstuffs, including margarines and low fat spreads. Low fat spreads are disclosed in US 4917915, for example. The fat phase is responsible for at least part of the oral properties of the foodstuffs. Certain low fat spreads are marketed for their health properties, including the ability to reduce cholesterol.

10

WO 98/28990 discloses a method of preparing food seasonings, food ingredients and food items using plant sterols and/or stanols together with raised levels of one or more of magnesium, calcium and potassium. Ingestion of the food is said to lead to a decrease in both cholesterol level and blood pressure.

15

There remains a need for food products comprising a fat continuous emulsion that have improved properties, including butter-like appearance and oral properties. There is also a need for food products of this type that have other health benefits and/or improved health properties.

20

Pine needles are the leaves of plants of the Pinaceae family, including the genus *Pinus*. Certain types of pine needles are available in abundant supply and have been used for various purposes. Pine needle extracts have been described as being useful in specific beverages in JP 08107778 A and JP 07059538. Rice cakes containing pine needle extracts are described in JP 01218562 A.

25

~~A process for the extraction of taxol from pine needles is described in WO~~
~~94/15483~~

- 5 High blood pressure (or hypertension) is known to be associated with many medical problems. High blood pressure directly increases the risk of coronary
- ~~people over 35 years old but environmental and genetic factors and some~~
- 10 medical conditions, such as diabetes mellitus, gout or kidney disease can lead to an increased risk of high blood pressure in people of all ages.

- US 6,329,000 discloses the use of certain pine needle extracts for treating various diseases including myocarditis, angina, arrhythmia, diabetes, senile dementia, sudden deafness and hypertension. The pine needle extracts are
- 15 obtained by a relatively simple extraction using water and alcohol as solvents.

Pine needle extracts have now been found to be useful for incorporation into food products comprising a fat continuous emulsion.

- 20 According to the invention, there is provided a food product comprising a fat continuous emulsion, wherein the emulsion comprises a material comprising one or more organic compounds, said material being obtainable as an extract from pine needles.
- 25 The extract is preferably an aqueous extract. When the extract is an aqueous extract, the food product comprises an aqueous phase and the material is preferably present in the aqueous phase.

The material preferably comprises at least 2 components A and B, wherein A is a compound that is obtainable from a mixture of A and B, such as pine needles, by elution from a silica column using 100 % methanol as eluent and B is a compound obtainable from the same silica column using methanol/water mixtures (5-40 % by volume) in a series of subsequent elutions. A is preferably selected from the group consisting of phytosterol, polyphenols, bioflavonoids, tannins, organic acids and their complexes. B is preferably selected from the group consisting of amino acids, peptides, proteins, quercetin, terpenoids, flavonol glycosides, biflavones, proanthocyanidins, polyprenols, lignans and minerals. The material may comprise one or more compounds A and one or more compounds B. Preferably, the material comprises A (or total A compounds where more than one A compound is present) in an amount of from 5 to 60 wt %, preferably 10 to 50 wt%, most preferably 15 to 40 wt%, and the material comprises B (or total B compounds where more than one B compound is present) in an amount of from 1 to 15 wt %, preferably 2 to 12wt %, most preferably 3 to 10 wt%, based on the weight of the material.

Therefore, in one embodiment, the material comprises at least one compound selected from the group consisting of phytosterol, polyphenols, bioflavonoids, tannins, organic acids and their complexes and at least one compound selected from the group consisting of amino acids, peptides, proteins, quercetin, terpenoids, flavonol glycosides, biflavones, proanthocyanidins, polyprenols, lignans and minerals.

25

The material preferably contains isocupressic acid compounds in an amount of less than 0.005 wt%, more preferably less than 0.003 wt%, even more preferably less than 0.002 wt% such as less than 0.001 wt%. The terms

"isocupressic acid compounds" and "isocupressic acids" are used synonymously herein and refer to isocupressic acid itself and preferably related diterpene acids found in pine needles and their extracts, such as imbricatoloic acid, agathic acid, dihydroagathic acid and tetrahydroagathic

- 5 acid. Preferably, the material is free of isocupressic acids or substantially free of isocupressic acids (i.e., to the extent that the presence of isocupressic acids properties of the composition).

- 10 The material is obtainable, and is preferably obtained, from pine needles. Pine needles are preferably from species of pine other than *Pinus ponderosa*. Pine species include *Pinus albicaulis*, *Pinus aristata*, *Pinus attenuata*, *Pinus balfouriana*, *Pinus banksiana*, *Pinus bungeana*, *Pinus cembra*, *Pinus cembroides*, *Pinus clausa*, *Pinus contorta*, *Pinus coulteri*, *Pinus densiflora*,
 15 *Pinus echinata*, *Pinus edulis*, *Pinus elliotii*, *Pinus engelmannii*, *Pinus flexilis*, *Pinus glabra*, *Pinus heldreichii*, *Pinus jeffreyi*, *Pinus lambertiana*, *Pinus longaeva*, *Pinus massoniana*, *Pinus monophylla*, *Pinus monticola*, *Pinus mugo*, *Pinus muricata*, *Pinus nigra*, *Pinus palustris*, *Pinus parviflora*, *Pinus pungens*, *Pinus quadrifolia*, *Pinus radiata*, *Pinus resinosa*, *Pinus rigida*, *Pinus sabiniana*, *Pinus serotina*, *Pinus strobiformis*, *Pinus strobus*, *Pinus sylvestris*,
 20 *Pinus tabulaeformis*, *Pinus taeda*, *Pinus thunbergiana*, *Pinus torreyana*, *Pinus virginiana*, *Pinus yuannensis* and *Pinus washoensis*. Preferably, the material is from *Pinus massoniana*, *Pinus tabulaeformis* or *Pinus yuannensis*, more preferably, the material is from *Pinus massoniana*. The material preferably
 25 comprises one or more organic compounds, more preferably two or more organic compounds. Organic compounds are compounds that comprise carbon, hydrogen and oxygen atoms and optionally other atoms such as nitrogen, phosphorus and sulphur.

The material is preferably obtainable by a process which comprises the following steps:

- treating pine needles with a solvent selected from water, organic solvents and mixtures thereof (preferably water), preferably at an elevated temperature of from 40 °C to 110 °C, to form a first extract;
- removing isocupressic acid compounds from the first extract by treatment with an ion exchange resin (preferably whilst the first extract is in aqueous solution, more preferably at an elevated temperature); and
- optionally, filtering and concentrating the treated extract to obtain the composition as a powder or a concentrate. Preferably, prior to step (a), the pine needles are pretreated with a non-polar solvent (e.g, an alkane having from 4 to 10 carbon atoms, such as hexane), more preferably at a temperature of from 40 °C to 90 °C. This pretreatment typically removes at least a part of the isocupressic acids.

- The food product can consist of, or consist essentially of, the fat continuous emulsion (e.g., in the case of certain margarines or low fat spreads). Thus, the fat continuous emulsion can constitute all of the food product. Alternatively, the food product can contain the fat continuous emulsion together with one or more other food ingredients or additives.

- The fat continuous emulsion preferably has a fat content of from 0.5 to 99.5 wt%, preferably 20 to 85 wt%, most preferably 30 to 80 wt%, based on the weight of the food product. Water is preferably present in the food product in an amount of from 0.5 to 99.5 wt%, more preferably 10 wt% to 50 wt%. The food product thus preferably comprises an aqueous phase and a fat phase.

The solid fat content of the fat in the fat continuous emulsion can conveniently be determined by measuring the NMR N-value as described in Fette, Seifen, Anstrichmittel, 80 (1978), 180-186, which indicates the amount of fat present in the solid state expressed in percentage of the weight of the fat. The fat phase

- 5 preferably displays a solid fat content (measured by NMR on a non-stabilised fat) at 5°C (=N5) of >10, more preferably >20, and a solid fat content at 35°C

- the N-value is measured after first melting the fat above 80°C, whereupon the melt is cooled to 0° C and kept at 0° C for 30 minutes, then the fat is heated to
10 the measurement temperature and kept at that temperature for 30 minutes, whereupon the N-value is measured.

- One embodiment of the invention is a food product comprising fat and water and having a fat content of from 0.5 to 99.5 wt %, wherein the fat phase
15 comprises at least two components (D) and (E), (D) having an N20>20 and (E) having a content of mono- and di-unsaturated fatty acid residues of at least 25 wt%. Component (D) is preferably selected from the group consisting of palm fractions, interesterified hardened palm oil and hardened palm kernel oil and fractions thereof, interesterified mixtures of liquid oils and hardened liquid oils,
20 interesterified fractions of palm kernel oil and palm oil, particularly palm kernel stearine and palm oil stearine, and fractions thereof, and fats containing at least 20 wt % of SUS triglycerides. Preferably, (E) has a content of mono- and di-unsaturated fatty acid residues of from 55 to 95 wt% and examples of component (E) include oils selected from the group consisting of sunflower oil,
25 high oleic sunflower oil, rape seed oil, high oleic rape seed oil, palm oil olein, corn oil, soybean oil and high oleic soybean oil. The weight ratio of (D) to (E) is preferably from 10:1 to 1:20, more preferably from 1:1 to 1:15, even more preferably from 1:4 to 1:10.

Preferably, the food products of the invention are essentially free of trans fatty acids (which are carboxylic acids containing from 12 to 24 carbon atoms and having one carbon-carbon double bond) i.e., they contain trans fatty acids in an amount of less than 1% by weight, preferably less than 0.5% by weight, more preferably less than 0.1% by weight, such as less than 0.05% or less than 0.01% by weight.

The food product preferably contains the material in an amount of from 0.01wt% to 20wt% (e.g., 0.01wt% to 1 wt%), more preferably from 0.05wt% to 15wt% (e.g., 0.05wt% to 1 wt%), even more preferably from 0.1wt% to 12wt% (e.g., 0.1wt% to 1 wt%), based on the total weight of the food product and on the weight of the dry material.

The food product of the invention preferably has one or more of the following properties compared to a corresponding product that does not contain the material: increased hardness, improved texture, increased aeration, improved spreadability, improved oral properties, improved mouthfeel, improved flavour impact, better colour, improved viscosity, increased ease of processing and improved health properties. The properties are improved compared to an otherwise identical food product that does not contain the material. Preferred properties that are improved according to the invention are oral properties and/or visual appearance, in particular increased similarity to butter in terms of oral properties and/or visual appearance.

25

The material of the invention has therapeutic activity. The term "therapeutic activity" in this context means usefulness in the treatment, inhibition or prevention of diseases or disorders. Diseases and disorders include, but are not

limited to, high blood pressure (hypertension). In one aspect, the invention provides a food product of the invention, for use to lower blood pressure in mammals, particularly humans.

- 5 The invention also involves a method of lowering blood pressure (and/or treating hypertension) in a mammal which comprises the provision of an
- contemplates the use of a food product of the invention in the manufacture of a composition for treating and/or preventing hypertension.

10

- Preferred food products of the invention are margarines, low fat spreads, bakery spreads and cooking spreads. These products may be packaged and labelled for sale and are typically stored at low temperature (e.g., below 15°C). Preferred packaging includes containers with lids, preferably of plastics
- 15 material and of a size sufficient to hold from 25 g to 1 kg of the food product.

- Margarines and spreads can be made by using conventional techniques for the preparation of margarines, low fat spreads or very low fat spreads (less than 40wt% fat) (as disclosed for example in EP 089082, the contents of which are
- 20 incorporated herein by reference).

- A spread preferably has a continuous fat phase to give it suitable spreadability and to prevent microbiological deterioration. It should not release moisture when it is being spread. Furthermore, a spread should preferably be spreadable
- 25 at refrigerator temperature (5°C), be stable at room temperature (20°C), but destabilize and release its flavour in the mouth.

The margarine or spread is a dispersion having a plastified continuous fat phase and a dispersed aqueous phase. As is common practice with respect to products of this kind, the term "continuous fat phase" is meant to include the oil present in the liquid state and forming a continuous phase as well as the solid fat particles contained in the liquid oil that have been phase-separated from the liquid oil by crystallization of fat by the plastification treatment. The "continuous fat phase" does not, however, include any fat contained in the dispersed aqueous phase, as occurs e.g., in a product having a so-called oil-in-water-in-oil structure

10

The aqueous phase may comprise, apart from water, a gelling agent and, optionally, a thickener and/or one or more other ingredients that are commonly incorporated in margarines and spreads, e.g. flavouring agents, colouring agents, emulsifiers, salt, preservative and acid.

15

Similarly, additives may be contained in the fat phase composition. For example, the fat phase composition may comprise a blend of triglycerides supplemented with one or more emulsifiers and/or colouring agents.

20 The aqueous phase composition may include some fat, but preferably the fat content of the aqueous phase composition is not higher than about 10 wt.%. It is particularly preferred that the aqueous phase composition comprises essentially no fat.

25 Throughout this specification the terms oil and fat are used interchangeably. They are meant to include triglycerides such as soyabean oil, sunflower oil, palm oil, fish oil, rapeseed oil, coconut oil, chemically and/or physically modified products such as hydrogenated, fractionated and/or interesterified

triglyceride mixtures and mixtures of two or more thereof, as well as edible substances that are physically similar to triglycerides such as waxes, e.g. jojoba oil, and poly fatty acid esters of mono- or disaccharides, and that can be used as replacement for or in admixture with triglycerides. Preferably, the fat

5 contained in the present spreads consists essentially of triglycerides.

amount and kind of emulsifier included are not critical. It is preferred to incorporate emulsifiers of the type and quantity as are commonly used in
10 spreads. For example, mixtures of mono- and diglycerides derived from natural, partially hydrogenated or fully hardened sunflower oil can suitably be employed, using an amount of about 0.2 to about 0.5 wt.%, calculated on the total weight of aqueous phase and fat phase. Alternatively, other oil-compatible emulsifiers can be used. Mixtures of such emulsifiers with mono-
15 and/or diglycerides can also be suitable as emulsifier.

Typically, the average droplet size of the dispersed aqueous phase is such that a satisfactory flavour release in the mouth can be obtained, while the product can have an adequate microbiological stability. Droplet sizes may be between
20 about 3 μm and about 60 μm , but it may be larger or smaller than that. The average droplet size, as referred to herein, is the volume weighted mean of the droplet size distribution. It can be determined with NMR following the procedure as described in J. Colloid and Interface Science (1972), 10, 206 and (1983), 93, 521.

25

The average droplet size of the present spreads can be varied easily, by adjusting the conditions during the preparation.

The present spreads can suitably be used e.g. on bread as butter substitutes. However, they can also be suitable for use as complete spread on their own, for example when containing a cheese or vegetable or fruit flavours or pieces.

- 5 The following non-limiting examples illustrate the invention and do not limit its scope in any way. In the examples and throughout this specification, all percentages, parts and ratios are by weight unless indicated otherwise.

Examples

10

Reference is made in the examples to Figure 1.

- Figure 1 shows the dose dependent contraction of rat aorta caused by phenylephrine and the inhibition of this effect by a pine needle extract of the
15 invention.

Example 1

Pine needle extraction

20

- 100 g pine needles from *Pinus massoniana* (isocupressic acids (ICA) content 0.33wt%) were cleaned with water, cut into small pieces (3~4 cm) and put in a flask. 500 g hexane was added to the flask and heated under stirring to reflux (~ 60°C) for about 3 to 5h. The resulting pine needle solution was filtered
25 through a Büchner funnel and the hexane removed using a rotary evaporator. The crude extract contains 8wt% of compounds of the isocupressic acid family. This extract was not used for further experiments.

The residue which was left after treatment with hexane was transferred to a flask and 500 ml demineralised water was added. The mixture was stirred at 100°C for about 3-5h. Then the extract was filtered through a Büchner funnel and concentrated to 150 ml. To this extract 12.5g resin (Dowex Marathon A,

- 5 Polysep Industrial Consultants) was added; the temperature was maintained at 50°C for 3h. After filtration through a Büchner funnel to remove the resin, the (ICA content 0.003wt%).

10 Example 2

- Thoracic aortas were obtained from spontaneous hypertensive rats (SHR). The thoracic aorta is cut into rings of 4 to 6 mm in length and each ring is connected to a tension transducer in a thermostatically controlled and oxygenated organ bath containing modified Krebs-Henselheit buffer. The contractions of rings of aorta are recorded continuously under isotonic conditions. After equilibrating the tissues, a single dose of 1µM phenylephrine was given to sensitise the tissue, followed by washout. Hereafter, two cumulative dose response curves of phenylephrine were generated. The first dose response curve was obtained in the absence of an extract and served as a control curve. After thorough washing (7 times) the tissues were incubated with the pine needle extract for 1 hour. Following this incubation period, a second dose response curve was obtained in the presence of a concentrated form of the extract. The data were analysed taking the maximal response of the reference curve as a control.
- 15
20
25

Figure 1 shows that phenylephrine causes a dose dependent contraction of rat aorta (the upper curve in the Figure). After incubation with pine needle extract

of Example 1, the contraction of rat aorta by phenylephrine is clearly inhibited (the lower curve in the Figure).

Example 3

5

The following is an example of a spread according to the invention. The spread can be prepared according to the procedure described in Example 14 of WO 97/18320.

10 Fat Phase:

Fat Blend*	40	%
Hymono 7804 (emulsifier)	0.3	%
Colour (2% β -carotene)	<u>0.02</u>	%
Total	40.32	%

15

*87:13 by weight sunflower oil and hardstock

Aqueous Phase (to pH 5.1):

Water	55.94	%
20 Pine needle extract (dry basis)	0.5	%
Skimmed Milk Powder	1.5	%
Gelatin (270 bloom)	1.5	%
Potassium Sorbate	0.15	%
25 Citric Acid Powder	<u>0.07</u>	%
Total	59.66	%

Claims

1. Food product comprising a fat continuous emulsion, wherein the emulsion comprises a material comprising one or more organic compounds, said material being obtainable as an extract from pine needles.
2. Food product as claimed in Claim 1, wherein the extract is an aqueous extract.
3. Food product according to Claim 1 or Claim 2, wherein the material comprises at least 2 components A and B, wherein A is a compound that is obtainable from a mixture of A and B by elution from a silica column using 100 % methanol as eluent and B is a compound obtainable from the same silica column using methanol/water mixtures (5-40 %) in a series of subsequent elutions.
4. Food product according to Claim 3, wherein compound A is selected from the group consisting of phytosterols, polyphenols, bioflavonoids, tannins, organic acids and their complexes, and minerals.
5. Food product according to Claim 3 or Claim 4, wherein compound B is selected from the group consisting of amino acids, peptides, proteins, quercetin, terpenoids, flavonol glycosides, biflavones, proanthocyanidins, polyprenols, lignans and minerals.

6. Food product according to Claim 1 or Claim 2, which comprises at least one compound A selected from the group consisting of phytosterols, polyphenols, bioflavonoids, tannins, organic acids and their complexes, and minerals, and at least one compound B selected from the group consisting of amino acids, peptides, proteins, quercetin, terpenoids, flavonol glycosides, biflavones,

7. Food product according to any one of Claims 3 to 6, wherein A is present in the material in an amount of from 5 to 60wt %, preferably 10 to 50 wt%, most preferably 15 to 40wt% and B is present in the material in an amount of from 1 to 15wt %, preferably 2 to 12 wt %, most preferably 3 to 10 wt%, all percentages being based on total weight of the material.

8. Food product according to any one of Claims 1 to 7, wherein the material contains compounds of the isocupressic acid family in an amount of less than 0.01 wt%, preferably less than 0.005 wt%, most preferably less than 0.003 wt%.

9. Food product as claimed in any one of Claims 1 to 8, wherein the fat continuous emulsion has a fat content of from 0.5 to 99.5 wt%, preferably 20 to 85 wt%, most preferably 30 to 80 wt%.

10. Food product according to any one of Claims 1 to 9, which is a margarine, a low fat spread, a bakery spread or a cooking spread.

11. Food product according to any one of Claims 1 to 10, wherein the fat phase displays a solid fat content (measured by NMR on a non-stabilised fat) at 5°C (=N5) of >10, preferably >20, and a solid fat content at 35°C (=N35) of <20, preferably <10, most preferably <5.

5

12. Food product according to any one of Claims 1 to 11, comprising fat and water and having a fat content of from 0.5 to 99.5 wt %, wherein the fat phase comprises at least two components (D) and (E), (D) having an N20>20 and (E) having a content of mono- and di-unsaturated fatty acid residues of at least 25 wt%.

10

13. Food product according to Claim 12, wherein component (D) is selected from the group consisting of palm fractions, interesterified hardened palm oil and hardened palm kernel oil and fractions thereof, interesterified mixtures of liquid oils and hardened liquid oils, interesterified fractions of palm kernel oil and palm oil, particularly palm kernel stearine and palm oil stearine, and fractions thereof, and fats containing at least 20 wt % of SUS triglycerides.

15

14. Food product according to Claim 12 or Claim 13, wherein (E) has a content of mono- and di-unsaturated fatty acid residues of from 55 to 95 wt%.

20

15. Food product according to any one of Claims 12 to 14, wherein component (E) is selected from the group consisting of sunflower oil, high oleic sunflower oil, rape seed oil, high oleic rape seed oil, palm oil olein, corn oil, soybean oil, high oleic soybean oil.

25

16. Food product according to any one of Claims 1 to 15, which is essentially free of trans fatty acids.

17. Food product as claimed in any one of Claims 1 to 16, wherein the

5 material is present in the product in an amount of from 0.05 wt% to 10 wt%, based on the total weight of the product.

18. Food product as claimed in any one of Claims 1 to 17, for use to lower blood pressure in mammals, particularly humans.

10

19. Food product according to any one of Claims 1 to 17, which has one or more of the following properties compared to a corresponding product that does not contain the material: increased hardness, improved texture, increased aeration, improved spreadability, improved oral properties, improved mouthfeel, improved flavour impact, better colour, improved viscosity, increased ease of processing and improved health properties.

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NEWPORT

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ABSTRACT
FOOD PRODUCT

5 A food product comprises a fat continuous emulsion, wherein the emulsion comprises a material comprising one or more organic compounds, said material being obtainable as an extract from pine needles.

Figure 1..

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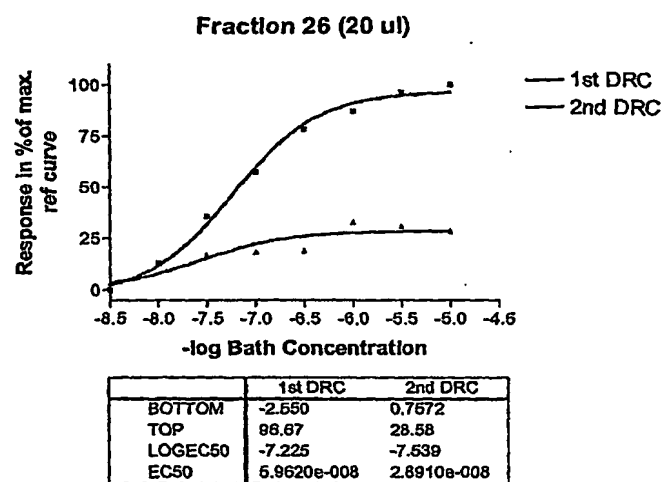


Figure 1

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